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The Sr-87/Sr-86 ratio as a powerful tool in forensic investigations

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As a result of the decay of the naturally occurring and long-lived radionuclide Rb-87 into Sr-87, the Sr-87/Sr-86 ratio of a geological material displays geographical variations according to the chemical/mineralogical composition of that material and its geological age. As most part of the strontium, ingested into the human body via the food, is transported to the skeletal tissue, the Sr-87/Sr-86 ratio of an individual's skeletal tissue is a reflection of the geological area in which that individual resided at the moment the skeletal tissue under investigation was formed. Distinct tissues in the human body display a different growth and Sr renewal rate, and hence reflect the place of residence in a distinct period of life (tooth enamel: childhood – tooth dentine and bone tissue: last years of life – nails: last months of life – hair: last weeks of life). Following these considerations, it was investigated if Sr isotope ratio analysis of human hair, nails, bone and dental tissue can be successfully applied in the context of forensic research.

Hair, nails, bone and dental tissue of several unidentified persons, currently being investigated by the Disaster Victim Identification unit of the Belgian Federal Police, were available for research. After acid digestion and isolation of the Sr fraction using an extraction chromatographic separation, the Sr-87/Sr-86 ratio of these tissues was determined via multicollector ICP-MS. It was shown that Sr isotope ratio data match traceable facts or information obtained via independent evidence concerning the victim, e.g., by pinpointing his/her area of residence. In this way, it was demonstrated that Sr isotope ratio analysis delivers information that strengthens or weakens arguments concerning a person's identity.